measurement method, and a bonding system that make it possible to estimate the state of the lower surface side of an electronic component mounted on a substrate.

Solution to Problem

[0006] A measurement device according to one aspect of the present invention is provided for performing measurement on an electronic component mounted on a main surface of a substrate. The measurement device includes: a measurement part measuring a component height position, which is a height position of an upper surface of the electronic component, and a substrate height position, which is a height position of a non-mount region of the main surface of the substrate where the electronic component is not mounted; and an estimation part estimating position information related to a mount region of the main surface of the substrate where the electronic component is mounted based on the component height position and the substrate height position measured by the measurement part.

[0007] According to this aspect, the position information of the region where the electronic component is mounted can be estimated based on the measurable component height position and substrate height position. Thus, it is possible to estimate the state of the lower surface side of the electronic component mounted on the substrate.

[0008] In the above aspect, the measurement part may measure the component height position and the substrate height position respectively at a plurality of measurement points along a first direction in a plan view of the main surface of the substrate, and the estimation part may estimate the position information in a direction along the first direction based on the plurality of measurement points of each of the component height position and the substrate height position measured by the measurement part.

[0009] According to this aspect, the position information in the direction along the first direction is estimated, and it is possible to estimate the state of the lower surface side of the electronic component in more detail.

[0017] According to this aspect, since it is possible to measure the height position without directly touching the electronic component or the substrate, the occurrence of damage to the electronic component and the substrate when measuring the height position is suppressed.

[0018] A bonding system according to another aspect of the present invention includes: the measurement device; and a bonding apparatus acquiring the position information estimated by the measurement device, adjusting inclination between the electronic component and the substrate based on the position information acquired, and bonding the electronic component and the substrate.

[0019] According to this aspect, since the inclination between the electronic component and the substrate can be adjusted more appropriately, it is possible to more accurately bond the electronic component and the substrate.

[0020] A measurement method according to another aspect of the present invention is provided for measuring an electronic component mounted on a main surface of a substrate. The measurement method includes: measuring a component height position, which is a height position of an upper surface of the electronic component, and a substrate height position, which is a height position of a non-mount region of the main surface of the substrate where the electronic component is not mounted; and estimating position information related to a mount region of the main surface of the substrate where the electronic component is mounted based on the component height position and the substrate height position measured.

[0021] According to this aspect, the position information of the region where the electronic component is mounted can be estimated based on the measurable component height position and substrate height position. Thus, it is possible to estimate the state of the lower surface side of the electronic component mounted on the substrate.

Effects of Invention

[0022] According to the present invention, it is possible to provide a measurement device, a

Here, although one semiconductor chip 320 is shown in FIG. 3 for ease of description, a plurality of semiconductor chips may be mounted on the main surface 302 of the substrate 300. For example, semiconductor chips may be respectively mounted on the main surface 302 of the substrate 300 at different positions on the xy plane.

[0038] Furthermore, the x-axis direction shown in FIG. 3 (hereinafter also referred to as “first direction”) is a direction parallel to the main surface 302 of the substrate 300 and one side 324 of the upper surface 322 of the semiconductor chip 320. In addition, the y-axis direction (hereinafter also referred to as “second direction”) is orthogonal to the x-axis direction, and the z-axis direction is orthogonal to the x-axis direction and the y-axis direction.

[0039] Here, the substrate 300 and the semiconductor chip 320 may be bonded by solder or the like provided between the substrate 300 and the semiconductor chip 320, for example. In this case, since the substrate 300 and the semiconductor chip 320 are heated during bonding, the substrate 300 and the semiconductor chip 320 may undergo deformation such as warpage due to thermal expansion. In FIG. 3, deformation of the substrate 300 and the semiconductor chip 320 is omitted.

[0040] The measurement part 120 measures a chip height position, which is the height position of the upper surface of the semiconductor chip 320, and a substrate height position, which is the height position of a non-mount region of the main surface 302 of the substrate 300 where no semiconductor chip is mounted. Here, in this embodiment, the height position is a position in the z-axis direction.

[0041] The measurement part 120 may measure the height position of the measurement object by irradiating the measurement object with light and detecting reflected light from the measurement object. At this time, the measurement part 120 may measure the height position using, for example, a triangulation method.

[0042] The measurement part 120 may measure the chip height position by irradiating the upper

the x-axis direction or the y-axis direction (an example of the first direction) in the plan view of the main surface 302 of the substrate 300. For example, the measurement part 120 can measure the chip height position at a plurality of measurement points along the virtual line 342 passing through the upper surface 322 of the semiconductor chip. In addition, the measurement part 120 can measure the substrate height position at a plurality of measurement points along the virtual line 341 passing through only the non-mount region where no semiconductor chip is mounted.

[0048] In this embodiment, the measurement part 120 can measure the substrate height position at a plurality of measurement points along each of the virtual lines 341 and 345. In addition, the measurement part 120 can measure the substrate height position at a plurality of measurement points along each of the virtual lines 342 to 344.

[0049] In addition, the measurement part 120 can measure the chip height position and the substrate height position respectively at a plurality of measurement points along each of the x-axis direction and the y-axis direction (an example of the first direction and the second direction that intersects the first direction in the plan view). In this embodiment, the measurement part 120 can respectively measure the chip height position and the substrate height position at a plurality of measurement points along virtual lines 361 to 365 in addition to the virtual lines 341 to 345 described above. For example, the measurement part 120 can measure the substrate height position at a plurality of measurement points along the virtual lines 361 and 365. Further, the measurement part 120 can measure the chip height position at a plurality of measurement points along the virtual lines 362 to 364.

[0050] Moreover, a plurality of measurement points of the substrate height position may be located at positions extending along an edge of a mount region. In this embodiment, a plurality of measurement points along the virtual lines 341, 345, 361, and 365 are located at positions extending along the edge of the mount region. The plurality of measurement points are located at positions close to the mount region. Therefore, by using the height position measured at the

plurality of measurement points, it is possible to more accurately estimate the state of the lower surface of the semiconductor chip.

[0051] Furthermore, the substrate 300 may have a plurality of semiconductor chips mounted thereon. In this case, the amount of deformation (warpage or inclination) of the substrate 300 and the thickness between the lower surface of the semiconductor chip and the main surface 302 of the substrate 300 may differ depending on where the semiconductor chip is mounted. At this time, if the plurality of measurement points to be measured are located at positions extending along the edge of the mount region, the height position corresponding to where the semiconductor chip is mounted can be used, and therefore, it is possible to estimate the state of the lower surface of the semiconductor chip more accurately.

[0052] Returning to FIG. 2, the functions of the estimation part 114 included in the measurement device 10 will be described. The estimation part 114 estimates position information related to the mount region of the main surface 302 of the substrate 300 where the semiconductor chip 320 is mounted based on the chip height position and the substrate height position measured by the measurement part 120. Here, the position information related to the mount region may be, for example, the height position of the main surface 302 of the substrate 300 in the mount region or the positional relationship between the substrate 300 and the semiconductor chip 320 (specifically, information related to the thickness between the lower surface of the semiconductor chip 320 and the main surface of the substrate 300).

[0053] Further, as described above, the measurement part 120 may measure the chip height position and the substrate height position respectively at a plurality of measurement points along the x-axis direction or the y-axis direction. In this case, the estimation part 114 can estimate the position information in directions along the x-axis direction or the y-axis direction based on the plurality of measurement points of each of the chip height position and the substrate height position measured by the measurement part 120. Thus, the measurement part 120 can estimate